Method for Producing a Packaging Filled with Tablets and One Such Packaging

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application of International Application PCT/EP01/14644, claiming priority under 35 U.S.C. § 365(c) of International Application PCT/EP01/14644, filed December 13, 2001 in the European Patent Office, and claiming foreign priority under 35 U.S.C. § 119 of DE 100 64 150.4, filed December 22, 2000, in the German Patent Office, DE 100 64 152.0, filed December 22, 2000, in the German Patent Office, and DE 101 30 391.2, filed June 23, 2001, in the German Patent Office.

BACKGROUND OF THE INVENTION

This invention relates to a process for the production of a pack filled with an active substance composition, more particularly a detergent, in tablet form, and to a pack filled with an active substance composition, more particularly a detergent, in the form of a compact tablet.

The teaching of the invention may be applied to the production of active substance compositions in tablet form that are marketed in a suitable pack. The active substance compositions in question are, in particular, detergents, such as laundry detergents and dishwasher detergents, and other water-soluble washing and cleaning aids, such as bleaching agents, color protectors, perfume formulations, enzyme compositions, etc. However, the process according to the invention may also be used for other active substance compositions that are to be marketed in tablet form in a protective pack.

However, a particular field of application of the process according to

the invention are in fact any forms of laundry detergents, washing aids, and dishwashing detergents in tablet form. Another field of application is water-soluble adhesives, more particularly pastes, in tablet form, which are used for pasting over large areas, for example for pasting wallpaper.

The production of active substance compositions, particularly detergents, in tablet form from generally finely crystalline, powder-form, or granular starting materials is generally carried out by tabletting in the presence of added fillers, binders, disintegrators, lubricants, or the like. The starting material is tabletted, for example, in eccentric presses or rotary presses under a pressure suited to the particular product.

It is known that active substance compositions, particularly detergents, can be packaged in tablet form. On the one hand, the tablet is thus protected against mechanical stressing; on the other hand, dermatologically aggressive components are occasionally processed in the production of detergents so that skin contact with the tablet is avoided by the pack. Finally, the pack prevents tabletted active substance compositions, particularly detergents, from prematurely absorbing moisture from the ambient air.

So-called flowpacks are known for packaging active-substance compositions, particularly detergents. Active substance compositions in tablet form are often packaged in pairs in flowpacks. In the case of a typical laundry detergent/washing aid combination for example, two such tablets are required for one wash cycle and are accommodated in an internally divided flowpack (**DE 198 40 390 A1**). Flowpacks are also known in practice for water-soluble adhesive tablets in tablet form.

A common type of pack for active substance compositions in tablet form is the blister pack. Blister packs are also used for detergent tablets (**EP 0 903 405 A2**). The prior art proposes a tabletted dishwashing detergent with a certain formulation. The tablets are produced in the usual way in a normal tablet press, for example a rotary press. The tablets

produced by the rotary press are collected and automatically placed in the holding "cups" of a preformed pack-forming film. When the cups have been filled with corresponding tablets, they are hermetically sealed on the open side by application of a closure film, more particularly by welding or bonding. Where production is continuous, corresponding strips of the closed pack – each comprising eight cups in the illustrated embodiment – are cut off and marketed as such.

The use of a blister pack for tabletted active substance compositions enables different – even mutually incompatible – active substances to be packed in separate cups and to be individually dosed. Skin contact with the active substance composition is readily avoidable. It is also possible to make up a marketing unit from several rows of cups filled with different active substance compositions, for example laundry detergents on the one hand and washing aids on the other hand.

The known blister pack has a pack-forming film of a plastic, more particularly a thermoplastic, transparent or translucent plastic, for example polyethylene.

Packaging of the tablets of the active substance composition in a blister pack enables the formulation of the active substance composition to be somewhat more freely selected because the demands that the dimensional stability of the tablet have to meet are smaller. Even if the tablet should break, the quantity of active substance remains accommodated in the cup pending use and, accordingly, is still available to the user. The above-mentioned transparent pack in particular can be very attractive to a potential customer.

Blister packs for tabletted active substance compositions have also been known for some time for a water-soluble adhesive, more particularly a paste (**DE 42 00 188 A1**). This prior art also discloses typical formulations for water-soluble adhesives based on natural starting products or water-soluble derivatives of cellulose and starch.

It has been found that the process for the production of a pack filled with an active substance composition, more particularly a detergent in tablet form, is in need of improvement in regard to the sequence of process steps.

DESCRIPTION OF THE INVENTION

The process according to the invention comprises the following steps:

a) a preformed pack-forming film comprising at least one integrally formed holding cup is inserted with the holding cup into a matching holder of a retaining mold;

b) a certain quantity of the as yet uncompressed active substance composition (premix) is introduced into the holding cup before, during or after process step a);

c) the quantity of active substance composition in the holding cup is compressed to a compact tablet in the holding cup itself by means of a compression mold using the holder of the retaining mold as a support;

d) on completion of process step c), the film with the active substance composition tablet in the holding cup is removed from the retaining mold and delivered to further handling stages;

e) before, during or after process step d), the holding cup is closed on its open side by application of a closure film or a cover.

The process according to the invention as described above is of particular advantage when the film is continuously delivered and the holding cups are formed in the film by means of a roller arrangement. In an alternative embodiment, the film is delivered in sections and the holding

cups are formed in the film by means of a flat thermoforming tool.

According to the invention, the tablet shape of the active substance composition is produced directly in the integrally formed holding cup of the pack-forming film. The holding cup of the pack-forming film held in a retaining mold as a support is also the compression mold for the tablet. According to the invention, the "tabletting" and "tablet packaging" steps are combined into a single process. The formation of the tablet in the pack itself eliminates the problem or edge breakage and erosion during handling of the tablets in the automatic loading machine.

Because the "tabletting" and "tablet packaging" steps are combined into a single process step, contact of the active substance composition, more particularly the detergent, with the ambient air during the production process can be kept very short. The hitherto usual conditioning of the production rooms can be reduced and confined to the delivery of the uncompressed raw material of the active substance composition.

As for the rest, a pack filled with a tablet-form active substance composition that has been produced by the process according to the invention naturally has the same advantages as the blister pack known from the prior art (EP 0 903 405 A2). Blister packs are only one variant of corresponding packs according to the invention. Related packs are push-through packs, press-through packs, skin packs, etc.

A particularly preferred embodiment of a process according to the invention for producing a pack filled with an active substance composition, more particularly a detergent, in tablet form does not require a preformed pack-forming film. This embodiment comprises the following process steps:

a) a pack-forming film is placed on a retaining mold comprising at least one holder forming a holding cup;

b) in a compression mold associated with the retaining mold and

comprising a premix holder associated with the holder of the retaining mold, a certain quantity of the as yet uncompressed active substance composition (premix) is introduced into and then preformed in the premix holder before or during process step a);

c) the mold is closed and the preformed active substance composition is pressed from the premix holder onto the pack-forming film and, together with the film, into the holder of the retaining mold, shaping the film into a holding cup in the process, and is compressed to a compact tablet in the holder of the retaining mold using that holder as a support;

d) on completion of step c), the film with the active substance composition tablet in the holding cup is removed from the retaining mold and delivered to further handling stages;

e) before, during or after process step d), the holding cup is closed on its open side by application of a closure film or a cover.

In the above-described variant of the process according to the invention, another production step is integrated into the process, namely formation of the holding cup(s) in the pack-forming film. On the one hand, the tablet is pressed from the premix of the active substance composition; on the other hand and at the same time, the pack-forming film is thermoformed in the holder of the retaining mold. In this embodiment of the process, the tablet of the active substance composition is on the one hand the object of the pressing step and, on the other hand, the power transmission medium for the thermoforming of the pack-forming film.

In another variant of this particular embodiment of the process according to the invention, the preformed active substance composition, more particularly detergent, is pressed out of the premix holder in step c) by means of a punch arranged for displacement in the compression mold. An alternative variant is wherein the preformed active substance

composition is pressed out of the premix holder in step c) by compressed air. The two pressure generating mechanisms may also be used in combination.

In another embodiment, the drawing of the pack-forming film into the holder in step c) is facilitated by air leaving the holder of the retaining mold or is actively supported by the suction of air from the holder of the retaining mold.

Other preferred embodiments and further developments of the process according to the invention are the subject of the other subsidiary process claims.

The present invention also relates to a pack filled with an active-substance composition, more particularly a detergent, in the form of a compact tablet and consisting of a pack-forming film provided with at least one integrally formed holding cup and a closure film or a cover closing the holding cup, the tablet being accommodated in the holding cup. More particularly, the invention relates to a pack produced by the process according to the invention.

According to the invention, the pack is wherein the edge of the tablet at the bottom of the holding cup corresponds in its edge profile to the edge profile of the holding cup. It is particularly useful if the tablet bears substantially over its entire circumference against the encircling inner wall of the holding cup. Even if the tablet should break, it thus remains dimensionally stable in the pack and stays usable for the user. The reject rate is also considerably reduced in this way.

In addition, a pack produced by the process according to the invention with the active substance composition accommodated therein in the form of a tablet is recognizable at least from the fact that the edge of the tablet at the bottom of the holding cup has a different contour from the edge of the tablet facing the open side of the holding cup and, in particular, is more rounded.

Preferred embodiments of the pack according to the invention are the subject of the other subsidiary claims relating to the pack.

DESCRIPTION OF THE DRAWINGS

Examples of embodiment are described in detail in the following with reference to the accompanying drawings, wherein:

Figure 1 is a plan view of a strip-form pack of several individual blisters arranged one behind the other.

Figure 2 is a schematic illustration explaining a first process for producing the pack shown in Fig. 1.

Figure 3 is a schematic illustration explaining a second process for producing the pack shown in Fig. 1.

Figure 4 is a plan view of a finished pack accommodating a total of 16 tablets of active substance composition.

Figure 5 is a side elevation of the pack shown in Fig. 4.

Figure 6 shows another embodiment of a pack comprising a plurality of tablets accommodated in individual holding cups.

Figure 7 is a plan view of a marketing unit comprising several packs each having two holding cups and tablets of active substance composition accommodated therein.

Figure 8 schematically illustrates a preferred embodiment of a pack according to the invention with a tablet of active substance composition accommodated therein.

As already discussed in the general part of the description, the process according to the invention is intended for the production of a pack filled with an active substance composition in tablet form. The pack may be an individual pack which, for example, has been cut off from the strip shown in Fig. 1. However, the pack may also assume the form of relatively large groups of packs, as the other examples of embodiment clearly show.

Active substance compositions of any kind can be accommodated in a pack by the process according to the invention. However, the teaching according to the invention relates more particularly to cleaning compositions, more particularly laundry detergents and washing aids for the cleaning of laundry and dishwasher detergents. Another particularly interesting application are water-soluble adhesives, more particularly pastes, as active substance compositions, as explained in the general part of the description. Particular reference may be made to the prior art already cited there with its disclosure on the subject of water-soluble adhesives in tablet form.

The blister strip shown in Fig. 1 of a thermoformable thermoplastic film, for example of polyethylene, shows integrally formed holding cups with an internal diameter of ca. 44 mm. This is the size for a tablet of an active substance composition which is suitable for typical laundry or dishwashing detergents. This size is of course just one example, the teaching according to the invention not being confined either to certain tablet sizes or to certain tablet shapes.

Figure 2 illustrates the basic principle of a process for the production of a pack filled with an active substance composition, more particularly a detergent, in tablet form. The process steps are described in the following:

A preformed pack-forming film 1 with at least one integrally formed holding cup 2 (in the example illustrated, four holding cups 2 situated beside one another) is placed with the holding cup 2 in a matching holder 3 of a retaining mold 4. In the example illustrated, the retaining mold 4 has four holders 3 adjacent one another. Before, during or after the process step explained above, a certain quantity of the as yet uncompressed active substance composition (premix) is introduced into the holding cup 2. Associated with the retaining mold 4 is a compression mold 6 provided with corresponding compressing projections 5. The mold 6 is lowered onto the retaining mold 4 from above, as indicated by arrows. The quantity of active

substance composition in the particular holding cup 2 is compressed to a compact tablet 7 in the holding cup 2 itself by means of the compression mold in conjunction with the holder 3 of the retaining mold 4 as a support. Figure 2 does not yet show the final state of the tablet 7, the compression step having not yet taken place. The tablets 7 are clearly visible in Fig. 1 in the holding cups 2 of the strip-like film 1.

On completion of the process step described above, the film 1 with the tablets 7 in the holding cup 2 is removed from the retaining mold 4 and delivered to further handling stages. Before, during or after this process step, the holding cup 2 is closed on its open side by application of a closure film 8 as shown, for example, on the extreme left of Fig. 1 in the interests of greater clarity. Instead of a closure film 8, which may be used with particular advantage to close a plurality of holding cups 2 of a relatively long film strip, covers or cover strips may also be used.

The film 1 can be provided with the holding cups 2 either continuously by means of a roller arrangement or in sections by means of a flat thermoforming tool. It is assumed for the purposes of the present process that the film is already provided with holding cups. Corresponding processes are widely known from the prior art for blister packs.

Figure 3 schematically illustrates an arrangement with which another process for the production of a pack filled with an active substance composition in tablet form can be carried out. This process comprises the following steps:

A pack-forming film 1 is placed on a retaining mold 4 which comprises at least one holder 3 that forms a holding cup (in the example illustrated, four holders 3 situated adjacent one another). In a compression mold 6 associated with the retaining mold 4 and comprising a premix holder 9 associated with the holder 3 of the retaining mold 4, a certain quantity of the as yet uncompressed active substance composition (premix) is introduced into and preformed in the premix holder 9 before or during the

process step explained above. Figure 3 (top) shows the preformed premix supplies in the premix holders 9 of the compression mold 6.

Arrows indicate that the mold as a whole is closed. The preformed active substance composition is forced out of the premix holder 9 onto the pack-forming film 1 and, together with the film 1 which it shapes into a holding cup in the process, is pressed into the holder 3 of the retaining mold 4 and compressed therein to form a compact tablet using the holder 3 of the retaining mold 4 as a support. Accordingly, this process step ends with the retaining mold 4 appearing as illustrated in Fig. 2.

In this process, the shaping of the film 1 by thermoforming is carried out at the same time as the compression step which again further simplifies the production process.

As for the rest, the other steps of the process described above are the same as those of the process illustrated in Fig. 2.

For the process in question here, Fig. 3 shows that the preformed active substance composition can be forced out of the premix holder 9 by means of a punch mounted for displacement in the compression mold 6. The mechanical drive source for the punch 10 is not shown in Fig. 3. Instead, Fig. 3 indicates a pneumatic drive source to the extent that the punch 10 and the preformed "cake" of active substance composition are displaced from the premix holder 9 by compressed air supplied via a compressed air system 11.

The illustrated and hence preferred embodiment also shows that the deformation of the film 1 into the holders 3 of the retaining mold 4 is supported by the suction of air from the holders 3 of the retaining mold 4 by means of the illustrated suction system 12. At least the retaining mold 4 should be provided at the holders 3 with air outlets to ensure that the holders 3 are vented rearwards during the thermoforming and compression step.

The illustrated embodiment shows that the process steps of both the

processes described above are each carried out quasi-statically on a section of film. Alternatively, however, these process steps may also be carried out on a continuous film 1 by means of roller assemblies, co-circulating belt arrangements or intermittently co-circulating tools. Corresponding processes are known from the prior art on tablet production, more particularly in conjunction with eccentric presses and rotary presses. However, the quasi-static procedure is particularly simple from the tooling perspective.

Typical pressures for producing tablets with an area of 10 to 15 cm^2 are between 10 and 60 kN.

Figure 4 shows that several holding cups 2 can be formed beside and/or behind one another and can be simultaneously filled with detergent.

Plastic films, more particularly PE films or PVC films, are preferably used for the pack-forming film 1. By contrast, the closure films 9 are paper-thin metal foils which typically can be pushed through or peeled off. The closure film 8 is fixed to the pack-forming film 1 by standard techniques, such as bonding, welding, high-frequency joining techniques, etc.

The pack-forming films 1 and the closure films 8, as plastic films, may generally be divided into water-insoluble and water-soluble films. Both types of film are equally suitable. Water-insoluble films are produced, for example, from PVC, PE, PP and mixtures of PE and polystyrene. Water-soluble films are made, for example, from polyvinyl alcohol, starch, cellulose, gelatine (with corresponding reactive additives). A particularly suitable water-insoluble film for the closure film 9 is of course the above-mentioned metal foil, i.e. in particular an aluminium foil.

The use of water-soluble films for a pack filled with an active substance composition has also been known for some time from the prior art (**WO 89/04282 A1**). The packaging of different water-soluble active substance compositions in a water-soluble pack for portioning and handling purposes is apparent from this prior art.

Figure 6 shows another pack modified to the extent that it is made childproof by an additional overcap 13 from which the marketing unit with several tablets 7 cannot be removed without additional manipulation in the arrowed direction. The cap 13 also provides a useful surface for advertizing, directions for use or company logos.

The closure film 8 or the cover can also be joined to the pack-forming film 1 in particularly childproof manner, for example by making the tear-open forces required so strong that they could not be applied by a small child.

A particular measure can be taken, for example, by making the closure film 8 a two-ply film between the layers of which an additional body of an active substance composition can be accommodated with protection. This additional body may be, for example, a perfume "sachet" which must not come into contact with the tablet 7 of active substance composition so as not to affect its storage life, but which can readily be removed from the pack together with the tablet 7. Corresponding additional bodies could also be formed by bleaching agents or enzyme components.

The illustrated embodiments make it clear that the pack-forming films 1 filled with tablets 7 of active substance composition in the holding cups 2 and provided with closure film 8 or covers are cut into typical commercial units (marketing units), optionally into single units (Fig. 5).

Figure 7, for example, shows a multiple pack with paired holding cups 2. The embodiment of Fig. 5 shows single holding cups 2.

Figure 5 also shows that, to form a marketing unit 14, several packs have been inserted into a paperboard carrier 15 with corresponding openings. The carrier 15 forms the "sales-active" surface of the marketing unit 14 of Fig. 4 which can be hung on display walls using a so-called Euro hanger.

Figures 4 and 6 show embodiments of marketing units which contain tablets 7 of different active substance compositions. For laundry care

purposes, a marketing unit as shown in Fig. 4 may contain, for example, two rows of detergent, one row of bleaching agent and one row of color protector or one row of enzyme-based washing aid. This flexibility in the filling of marketing units 14 comes from the individual accommodation of the tablets 7 in the individual holding cups 2.

The direct compression of the active substance premix in the holding cup 2 or the holder 3 of the retaining mold 4 in both variants of the described process enables a formulation with few, if any, dimensionally stabilizing components to be used for the active substance composition. The tablet 7 is situated from the outset in the holding cup 2 of the film 1 and is not itself handled in the production process for the pack.

As for the rest, reference is again made to the general part of the description so far as the advantages of the process according to the invention are concerned.

Figures 4 and 5 illustrate the final form of a filled, marketable pack in a particularly preferred embodiment. The pack consists of a pack-forming film 1 provided with at least one integrally formed holding cup 2 and a closure film 8 (or a corresponding cover) which closes the holding cup 2. The tablet 7 of active substance composition is hermetically sealed in the holding cup 2.

The effect of directly forming the tablet 7 in the holding cup 2 is that the edge of the tablet 7 at the bottom of the holding cup 2 corresponds in its profile to the edge profile of the holding cup 2. In practice, this edge is not as sharp as indicated in Fig. 5, but is rounded off with a radius that suits practical requirements. The compression step in the holding cup 2 with the holder 3 of the retaining mold 4 as support ensures that the edge of the tablet 7 formed is correspondingly adapted.

Another effect of the compression step in the holding cup 2 is that the tablet bears against the encircling inner wall of the holding cup 2 over virtually its entire circumference. This has also not been shown in Fig. 5 to

enable the pack-forming film 1 to be distinguished from the edge of the tablet 7.

Finally, a pack of the type in question is generally made in such a way that the edge of the tablet 7 at the bottom of the holding cup 2 has a different contour from the edge of the tablet 7 facing the open side of the holding cup 2 and, more particularly, is more rounded than that contour. The compression tool, i.e. preferably the punch 10 on the compression mold 6, enters the holder 3 and leads to a sharp edge contour of the tablet 7 possibly showing a slight encircling bead. This is not the case with the edge of the tablet 7 at the bottom of the holding cup 2.

In practice, the formation of separate holding cups 2 for holding a tablet 7 of the active substance composition creates a number of possibilities for the design of the tablets 7, more particularly laundry detergent tablets or washing aid tablets.

There are also numerous possibilities for the design of the pack.

In the prior art, as described at the beginning, the film 1 and the closure film 8 are normally disposed of as waste after the tablets 7 accommodated in the pack have been used.

According to a first proposal, this has now been changed to the extent that the pack-forming film 1 and the closure film 8 or the cover consist of water-soluble materials, more particularly water-soluble plastics or water-solubilized plastics, and, in order to use the active substance composition, more particularly the detergent, in a water bath, the pack as a whole is added to the water bath. The problem of waste from the pack is thus readily solved for the user and it is only where other materials are used in a multiple pack (marketing unit), for example where the above-mentioned carrier 15 of paperboard is used, that those materials have to be disposed of as wastepaper.

In this connection, reference may be made to the above references to water-insoluble and water-soluble films.

A water-soluble pack-forming film 1 or closure film 8 may be attended by the problem that, in the event of prolonged storage, it absorbs so much water from the surrounding atmosphere that it loses its protective effect. Accordingly, it may be advisable additionally to wrap the pack in a thin film substantially impermeable to water vapor for the purposes of transportation and storage. This film may be designed solely for the task of keeping out water vapor and need not have to withstand severe mechanical stressing because this purpose is of course served by the pack-forming film 1 in conjunction with the closure film 8.

For the release, particularly the delayed release, of active substance, it is occasionally advisable to provide the active substance composition with a coating. The described solution enables the pack-forming film 1 and the closure film 8 to have material properties of a coating corresponding to the intended application of the active substance composition.

In an alternative advantageous design of a pack of the type in question, the tablet 7 has a multilayer structure of at least two layers 20, 21 of identical or different active substance compositions and at least one layer 22 of a neutral release agent.

Figure 8 shows an example of a correspondingly modified tablet 7 which may be used one or more times in the same pack. Through the introduction of a neutral layer 22 of a release agent, the active substance components in the two other layers 20,21 are separated from one another. Mutually incompatible components of the active substance composition can thus be processed in one and the same tablet 7. The stability of the pack enables this to be readily achieved because the boundary layers between the individual layers of a multilayer tablet 7 are not exposed to major forces in this pack. In addition, the pack closely surrounds the tablet 7 and keeps it dimensionally stable, particularly where it is produced by the process described at the beginning.

In addition, suitable marking materials may be embedded or present in the layers 20, 21, 22, more particularly in the layer 22 of release agent, for product identification purposes.

Another alternative for the design of the tablet 7 is wherein a solid additional body, a paste-like additional body or a liquid additional body surrounded by a protective envelope, more particularly a gel-form envelope, is provided in the tablet 7 either inside or towards the upper or lower outer surface. Different active substances can be accommodated in the same tablet 7 in this way also.

Finally, the pack offers another advantageous design possibility which is wherein the closure film 8 is a two-layer film and in that an additional body of an active substance composition is arranged between the layers of the closure film 8. It is possible in this way, too, to accommodate an additional, possibly incompatible, active substance composition separately from the tablet 7 in the pack and nevertheless to ensure that it is dosed at the same time as the tablet 7 at the point of use. For example, a perfume sachet, enzymes or a bleaching component may thus be added to the washing process.

The two-layer construction of the closure film 8 can be of particular importance for delayed cleaning processes when a water-soluble closure film 8 and a pack-forming film 1 are provided. This is because the outer layer of the closure film 8 can first be dissolved so that active substance composition present between the layers is released. After a given time interval, the inner layer of the closure film 8 and the pack-forming film 1 itself are dissolved and release the tablet 7 with the other active substance composition, again after a given time interval. This delayed release of active substance composition is applied not only in laundry care, it may also be applied, for example, to a cleaner for lavatory bowls.

As already mentioned, the relatively large pack described has several holding cups 2 and tablets 7 of mutually incompatible, storable

active substance compositions are accommodated in the holding cups 2 and/or several packs are placed in a paperboard carrier 15 with corresponding openings.